upon the Board of Agriculture and Fisheries for securing the use of unoccupied land for purposes of food production.

In view of the difficulty of securing delivery of basic slag, superphosphate, and other phosphatic manures, the President of the Board of Agriculture and Fisheries asks farmers not to apply phosphates to meadows and pastures during the remainder of the present season. All available supplies should be reserved for other crops, especially for roots and potatoes. Having regard to the short supplies, it is not advisable to apply more than three-fourths of the usual dressings of these phosphatic manures, since better results may be expected from the same total weight of manure if the whole area under any particular crop is manured lightly than if a part is heavily dressed and the balance left without artificial manure. This rule applies only where the land is uniform in quality. In those cases in which farmers know that certain fields are poorer than others the manurial treatment must be adapted to the special conditions. Where land in good condition can be given full dressings of farmyard manure, artificial phosphatic manures may often be omitted without materially reducing the crops.

At the meeting of the Society of Glass Technology, held at the University of Sheffield on February 15, some samples of glass manufactured from British sands were exhibited by Mr. C. J. Peddle, but the principal business of the meeting was the discussion of the effect of the temperature at which the annealing of glass is carried out on the time required by the process. Contributions to the discussion were made by Mr. F. Twyman, of Messrs. Adam Hilger, Ltd., London, and by Mr. S. English, of the Glass Technology Department of the University of Sheffield. As the temperature is raised towards the softening point of the glass, the speed at which the internal strains disappear is increased, and the object is to find for each type of glass the highest temperature at which it is safe to carry out the annealing process. The observations are conveniently made on a glass rod mounted between Nicol prisms, so that light passing through the system shows the rings and cross characteristic of a uniaxial crystal. As the annealing proceeds the rings disappear, and the times of disappearance of the last four rings were found in a particular sample of glass to be as follows: At 500° C. 1230 minutes, at 550° C. 50, at 600° C. 20, and at 625° C. 12. These temperatures are all considerably below that of actual softening of the glass.

Vol. xii. of "Contributions from the Jefferson Physical and the Cruft High-tension Electrical Laboratories of Harvard University" for the year 1915 consists of reprints of nineteen papers, the outcome of researches aided financially by the Coolidge fund for research, the Bache fund of the National Academy of Sciences, and the Rumford fund of the American Academy of Arts and Sciences. The volume extends to 400 pages, and is a record of which Harvard may well feel proud. The Cruft laboratory provides two of the nineteen papers—one by Mr. F. Cutting on the design of radiotelegraphic transformers, another by Mr. E. L. Chaffee on coupled circuits. Of the Jefferson laboratory contributions, that of the director, Dr. T. Lyman, is of special interest, as it extends the ultra-violet end of the spectrum to wave-length 600 Ångström units. Dr. P. W. Bridgman's five valuable contributions occupy a large share of the volume, and deal with the effect of great pressures on the temperature and velocity of transition of polymorphic forms of the same substance into each other. Altogether, 150 substances have been examined, and it is unfortunate that the polymorphic diagrams obtained show no tendency to fall into simple types. The subject appears to be very complicated, and Dr. Bridgman suggests that the explanation of the great variety of behaviour of the different substances must be sought in the actual shapes of the atoms.

A copy of the Year-Book of the Scientific and Learned Societies of Great Britain and Ireland, 1916, has been received from Messrs. Charles Griffin and Co., Ltd. This, the thirty-third annual issue of a useful work of reference, contains a record compiled from official sources of the work done in science, literature, and art during the session 1915–16 by numerous societies and Government institutions. The list of societies dealt with is remarkably comprehensive; but the plan of selection is not always clear. Under the section entitled Psychology, for instance, space has been found for particulars of the Nature Study Society and the School Nature Study Union, but nowhere in the volume have we found data concerning the work of, say, the Association of Public-School Science Masters. Similarly, under the section Literature and History, the English Association is included, while the Historical Association is overlooked. The man of science, however, will find the volume as useful as ever in discovering the work done in his particular subject during the year under review. The book is published at 7*s*. 6*d*. net.

An interesting and very full botanical catalogue (New Series, No. 77) has just been issued by Messrs. J. Wheldon and Co., 38 Great Queen Street, W.C. It comprises floras of all countries, and is arranged most conveniently according to the countries dealt with. Many of the works are scarce. We notice that several belonged to the late Sir Joseph Hooker.

Prof. Fraser Harris writes to correct an error made by him in his letter in Nature of January 18 (p. 389) on the introduction of the term "metabolic." He referred to the first edition of Foster's "Text-book of Physiology" as having been published in 1883, whereas it appeared in 1877.

OUR ASTRONOMICAL COLUMN.

Effect of Haze on Solar Rotation Measures.—Attention has previously been directed to Mr. De Lury's suggestion that the apparent variations in the rate of solar rotation, as determined by the spectrographic method at different times, and from different lines, might be accounted for by variations in the haziness of the sky (Nature, vol. xcviii., p. 99). Messrs. St. John and Adams have since made observations to test the possible influence of haze, and have found that to obtain equality of density in photographs of the spectra at points just outside and just within the sun's limb, it was necessary to give exposures in the ratio of 100 to 1. These observers concluded that, under the usual working conditions at Mt. Wilson, scattered radiation is a negligible factor, and is not a probable source of error in the observations of solar rotation (Journ. R.A.S., Canada, vol. x., p. 553). In a further note on the subject (*ibid.*, vol. xi., p. 23) Mr. De Lury points out that the density of a negative is proportional to a power of the time, usually within the range 0·6 to 0·9, and that equal densities with a ratio of 100 in the times of exposure would correspond to a ratio of scattered light to limb light ranging from 6·3 to 1·6 per cent. A probable value would be about 4 per cent., which would produce about half the effect noted in the Mt. Wilson observations, and, allowing

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for other circumstances, could conceivably account for the whole effect. If atmospheric haze be proved insufficient, it is alternatively suggested that the differential effects may possibly be accounted for by assuming the production of a spectrum of non-rotating matter in the solar atmosphere.

THE NINTH SATELLITE OF JUPITER.—An investigation of the ninth satellite of Jupiter has led Messrs. Nicholson and Shapley to estimate its diameter as lying between 11 and 17 miles (*The Observatory*, vol. xl., p. 107). From photographs of this tiny object taken with the 60-in. reflector at Mt. Wilson, the photographic magnitude at mean opposition was found to be 18·6, as compared with 17·5 and 18·0 for the seventh and eighth satellites respectively. Allowing for a probable colour-index of one magnitude, the angular diameter of the ninth satellite at mean opposition works out at 0·006″ or 0·009″, according to the value adopted for the visual albedo, and these lead to the limits of diameter stated above.

GERMANY'S EFFORT TO OBTAIN NITROGENOUS COMPOUNDS.

ALTHOUGH elementary nitrogen is not only useless, but positively antagonistic, to the life of plants and animals (except to that of some bacteria which take free nitrogen from the atmosphere and convey it to the roots of leguminous plants), combined nitrogen is absolutely necessary for their metabolism. Animals obtain nitrogen from the vegetables they consume, plants from the nitrogenous constituents of the soil. The soil obtains part of its combined nitrogen from decaying vegetable matter and from the waste products of animals; the remainder has to be added. The two chief forms in which it is added are sodium nitrate and ammonium sulphate, which to a large extent are interchangeable. But for the manufacture of explosives sodium nitrate is absolutely necessary and ammonium sulphate useless. Germany, foreseeing that its supply of Chilean nitrate would be cut off by the blockade of the British Fleet, was faced with irremediable disaster unless it could lay in a sufficient stock before declaring war, or devise methods of synthesising nitric acid. The manner in which this difficulty has been overcome is described by Prof. Camille Matignon in the *Revue générale des Sciences* (January 15 and 30). Before the war Germany was the greatest consumer of combined nitrogen. In 1913 the consumption amounted to 750,000 tons of Chilean nitrate, 35,000 tons of Norwegian nitrate, 46,000 tons of ammonium sulphate, and 30,000 tons of cyanamide. In 1913 great efforts were devoted in Germany to the preparation of materials necessary for war, and no attempt was made to conceal them. The German Ammonium Sulphate Syndicate had a reserve of 43,000 tons, and on the declaration of war there was probably a stock of 100,000 tons of Chilean nitrate. Immediately after the battle of the Marne, when a long war was evidently certain, the production of artificial nitrates and of ammonium sulphate was stimulated, the Badische Aniline Company and Bayer and Co. being subsidised to the extent of 30,000,000 marks for the installation of factories to convert ammonia into nitric acid. In peace time 550,000 tons of ammonium sulphate were produced annually in Germany, but this output was reduced once war was declared. As this substance is a by-product in the manufacture of gas and cast-iron, people in Germany were instigated to use gas and coke instead of coal, and by such means an annual output of 250,000 tons of ammonium sulphate was attained. The problem of converting the ammonia into nitric acid was solved by the Frank and Caro and the Kayser processes. A French chemist, Kuhlmann, had discovered that ammonia is oxidised to nitrogen peroxide when mixed with air and passed over warm, finely divided platinum. The reaction was employed on a commercial scale by Ostwald, and improved both by Kayser and by Frank and Caro. By the end of 1915 the Anhaltische Maschinenbau Society of Berlin had established thirty installations for the conversion by Frank and Caro's process, and these had a capacity of more than 100,000 tons of nitric acid per month. But this was only one of the methods adopted. Given a cheap source of electrical energy, it was known to be commercially practicable to prepare nitric acid by the direct oxidation of nitrogen in the electric flame, and this process had been established in Norway by Birkeland and Eyde, who used the waterfalls as a source of energy. The Germans have established a factory employing Pauling's process (a modification of that of Birkeland and Eyde) at Muhlenstein, in Saxony, in the neighbourhood of the lignite beds, which form the source of energy, and this has an annual output of 6000 tons of nitric acid.

The third principal method adopted for the preparation of combined nitrogen was the direct synthesis of ammonia. Bosch and Mittasch, two chemical engineers of the Badische Company, had adapted Haber's synthesis to industrial conditions, and the company had established a factory with an annual output of 30,000 tons of synthetic ammonium sulphate. In April, 1914, the company increased its capital in order to raise the output to 130,000 tons, and after the battle of the Marne it was subsidised by the German Government to increase the production to 300,000 tons.

Before the war the production of cyanamide in Germany was comparatively small, but it has increased largely under Government stimulus. The cyanamide manufacturers desired a monopoly, but this was opposed by the Badische and other companies and by the gas manufacturers, and the project seems to have been abandoned.

In the direction of the manufacture of manures, it was necessary to economise sulphuric acid, so ammonia was neutralised with nitre cake, and the resulting mixture of sodium and ammonium sulphates was mixed with superphosphate. Moreover, it was found that superphosphate will absorb gaseous ammonia, and although the calcium acid phosphate is thereby converted into the insoluble tricalcic phosphate, it is formed in an easily assimilable condition, and the product is found by experience to act both as a nitrogen and phosphorus manure.

Prof. Matignon seems to be correct in claiming that chemistry has saved Germany from disaster.

E. H.

SUBSIDENCE RESULTING FROM MINING.

THE very important question of subsidence resulting from mining operations has recently been discussed in a bulletin issued by the Engineering Experiment Station of the University of Illinois. The report is prepared by Dr. L. E. Young, mining engineer for the Illinois Coal Mining Investigations, and Prof. H. H. Stock, professor of mining engineering in the University of Illinois, under a co-operative agreement between the University, as represented by its Engineering Experiment Station, the Illinois State Geological Survey, and the United States Bureau of Mines. Apparently, whilst we in this country content ourselves with talking about the need for closer co-

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